TEACHING EVIDENCE-BASED MEDICINE IN THE FORMER SOVIET UNION: LESSONS LEARNED

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ABSTRACT

Between 2009 and 2012, I taught principles of evidence-based medicine and clinical research in Russia, Tatarstan, Moldova, and Kazakhstan. The Soviet Union left a medical legacy characterized by balkanization of top tier medicine in highly specialized centers, so there was little capability for multidiscipinary care. In addition, the authoritarian government led to a persistently top-down tradition of medical education and practice, which one of my Russian colleagues aptly named "eminence-based medicine." After the fall of the Soviet Union, funding for science and medical research was drastically cut, leading to a struggle for resources and politicization of resource decisions. At present, prejudices and beliefs about disease and treatment persist untested, limited English language competency impedes acquisition of new knowledge, and restriction of resources cripples innovation. Yet none of these conditions are unknown to us in the United States. Physicians may resist evidence that challenges long-held beliefs, and patients want us to make decisions based on their individual case, not evidence arising from studying other people. As physicians, we need to understand how to communicate with and frame our arguments so that they can be understood and received favorably. Can we draw lessons from trying to teach evidence-based medicine in the former Soviet Union?

INTRODUCTION

Between 2009 and 2012, I had the opportunity to teach principles of evidence-based medicine and clinical research in four very divergent venues in the former Soviet Union (FSU). These experiences both illuminated for me the obstacles to the practice of good medicine in many parts of the world and also taught me some lessons I think are applicable to how we talk to our colleagues and patients here in the United States.

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SOVIET MEDICINE

In the Soviet Union, all health care and its personnel were owned and employed by the state. Healthcare was considered a right of all citizens. In addition, the population of the Soviet Union became relatively well educated, with literacy rates (for those 15 years old) of 99.7% for males and 99.2% for females by the 1990s. However, both medical education and health care were quite substandard, despite the accomplishments of the Soviet Union in other areas of science.

Physicians

Primary care was largely provided by minimally trained and overworked physicians in environments with minimal resources. Local hospitals outside the major cities often lacked basic laboratories and sometimes even sufficient plumbing to maintain adequate hygiene. Student physicians graduated from enormous undergraduate medical schools, and most received little practical medical training comparable to US residency programs. Once working, physicians were mostly poorly compensated, often earning no more than laborers. They were unmotivated to continually expand and update their knowledge, as they anticipated being unable to use it as well as remaining uncompensated for their additional efforts. Physicians working in clinics were mandated to see eight patients per hour. Giving physicians bribes to ensure that a family member received at least adequate medical treatment became commonplace in the Soviet Union, so that such bribes were often a physician's main source of income. In addition, both linguistic and political barriers kept Soviet physicians out of step with medical progress elsewhere in the world.

Hospitals

Secondary and tertiary hospitals were organized by specialty, with a great deal of compartmentalization of resources and specialties. Typically, a cardiovascular hospital would not have neurologists, neurosurgeons, or trauma doctors, whereas neurology hospitals would not have physicians representing most internal medicine specialties, such as infectious diseases, endocrinology, etc. Use of clinical laboratories was sparse, so that patients undergoing major surgery, such as colectomy for cancer, were discharged after a relatively long hospital stay that involved at most only two or three laboratory measurements of blood counts or electrolytes.

Pharmaceuticals during Soviet days were of poor quality if made domestically, and prohibitively expensive if imported. While health care was considered a right, medicines had to be purchased by the patients, putting many medicines out of reach of most citizens. In addition, nutritional support in most hospitals was so inadequate that patients were obligated to have family members bring meals.

Patients

Medicine was traditionally conducted in an authoritarian manner, in which patients were obligated to accept the treatments ordered by their doctors. If a patient asked a nurse what medicine the nurse was administering, he would likely receive as answer "I'm giving you what the doctor ordered," without further explanation. Choices were essentially never offered, even when feasible. Thus, while patients did not trust their doctors, they had little choice in their healthcare. Nevertheless, in the waning days of the USSR, life expectancy was slightly more than 70 years.

MEDICINE AND HEALTH IN THE RUSSIAN FEDERATION

After the break-up of the FSU, the new Russian Federation's constitution provided all citizens the right to free healthcare under a mandatory health insurance mechanism. Although in place since 1996, this resulted in per capita annual health expenditures of only US$158, compared to $4187 in the US in 2000. In 2008, 621,000 doctors and 1.3 million nurses were employed in the Russian healthcare system. The number of doctors per 10,000 people was 43.8, but only 12.1 doctors per 10,000 people served in rural areas. In contrast, there are about 24 physicians per 10,000 people in the US (data.worldbank.org). Furthermore, the number of general practitioners as a share of the total number of doctors was only 1.26%.

The large shifts in both the Russian economy as well as in healthcare resulted in a sharp decrease in life expectancy, which has only recently been improving (Figure 1). Mortality appears largely due to cardiovascular disease (55%) and cancer (15.2%). Russia is also, however, the world leader in smoking (43.9 million adults, 31% of the total population) and a leader in the consumption of alcohol on a per capita basis.

Moreover, reforms have in many respects made the medical system worse. Medical education remains largely un-reformed: A medical degree is a 6-year bachelor's degree, and a majority of those who obtain such a degree never practice medicine. In fact, a degree in medicine is considered a suitable education for a housewife, much like a degree in

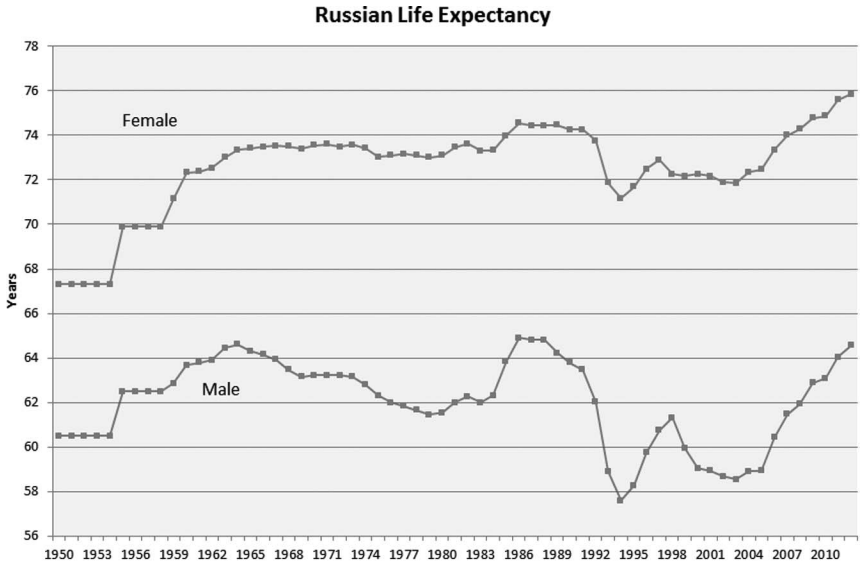

FIG. 1. Life expectancy in Russia. By LokiiT [CC-BY-3.0 http://creativecommons.org/licenses/by/3.0)], via Wikimedia Commons, data derived from Rosstat.

home economics was two generations ago in the US. Education in basic sciences is generally substandard and rarely addresses the experimental evidence underlying concepts of physiology and pathophysiological mechanisms of disease. Post-graduate education/training is usually 1–2 years, even for specialists. Academicians do a 3-year "research" training ending with award of a PhD. Understanding the English language is not required in many schools, and therefore students and post-graduate trainees often still learn in isolation from the world's medical literature.

Private insurance, although now legal and available, has not resulted in market competition outside of a few large cities. Most Russians receive health insurance through their workplace. These insurance organizations dictate what doctors they will see and which hospitals they will go to. Medicines must still often be purchased by the patient without benefit of insurance. Insurers provide house-call physicians (usually minimally trained general practitioners) for acute illnesses; if the physician feels the patient needs medical care or diagnostic testing beyond what can be done at home, the patient is sent to a designated hospital, depending on what the physician thinks is going on. Outpatient clinics are generally available only for well-patient visits and some specialty visits.

In general, hospitals are under-resourced, and allocation of resources remains in the hands of the centralized government agencies

and their regional sub-agencies, and thus highly political. Accordingly, budgetary decisions are often made to please political constituencies rather than to meet clinical needs.

TEACHING EVIDENCE-BASED MEDICINE IN THE FSU

Medical Education in Moscow, Russian Federation

As a Fulbright scholar in Moscow for 3 months in 2010, my main job was to lecture senior students and residents at the Russian State Medical University based in Moscow (Figure 2). The student population is quite international, drawing from the FSU as well as a large number of developing countries in Africa and Asia. This university provides bachelor degree-level education to approximately 1900 students in medicine, pharmacology, dentistry, and other allied health disciplines (Figure 2).

Foreign citizens must provide evidence of completion of a secondary school education and then must satisfactorily complete a 1-year course in the "preparatory department," during which they study the Russian language, biology, physics, mathematics, and chemistry. After completion of medical studies, students may enter into a Candidate of Science degree, which ordinarily takes about 3 years and requires performance of research and presentation of a dissertation; this is ordinarily considered equivalent to our PhD, but it does not require extensive didactic training. There is also a further Doctor of Science degree, which many budding academicians pursue. One year of post-graduate clinical training is needed to actually practice medicine, even as a specialist.

My lectures were presented in the late afternoons and early evenings, to enable both students and residents posted in various city hospitals to attend. In addition, I presented several lectures in the city hospitals themselves to reach more of the residents and faculty there. Among the medical students, most attendees were Asian and African, as they tended to have better English skills, and my lectures were given in English with bilingual English/Russian slides. Those Russian students who chose to attend likewise had good English skills, and

FIG. 2. The Russian State Medical University. The main hall connecting the two primary buildings of the university is prominently decorated with a Soviet-style mural extolling achievements of Russian medicine (www.rsmu.ru).

many sought advice about pursuing clinical training or education in the US. Faculty members both at the medical school and various teaching hospitals generally did not have the ability to converse in English, although there were a few exceptions, largely among those who had done some training outside of Russia.

My initial lectures focused on describing evidence-based medicine (EBM). Interestingly, the translation of this term in Russian actually says "медицина, основанная на доказательствах" (meditsina, osnovannaya na dokazatel'stvakh), which translates to "medicine based on evidence." In trying to explain this concept, however, I found that most students had approached learning medicine by memorizing "givens," which some Russian doctors jokingly called "eminence-based medicine." They were not rewarded by their educational system for asking "how" and "why." Therefore, they persisted in asking questions that showed little understanding of basic pathophysiology beyond that of a lay person. And they had even less understanding of Dr Sackett's definition (1) of EBM as "the integration of best research evidence with clinical expertise and patient values."

During their clinical experiences, students had little role in provision of patient care in the hospital. They did not participate in work rounds and made no entries into the medical record. They had no direct patient care responsibilities, and their work day was generally 9 AM to 2 or 3 PM. They were not expected to read beyond their textbooks and, occasionally, a review article, despite the fact that the medical university had online library subscriptions to a great deal of Western medical journals (all of which, however, required English skills). When told how American medical students participate in patient care, several students reacted by saying that they thought such roles were abusive of patients. However, at the same time, their professors rarely saw fit to explain their decision making to their students or patients. Most often, clinic visits ended when a nurse handed a patient instructions or a prescription with the simple comment that "this is what the doctor recommends." Thus, it was an uphill battle to convince students and residents of the value of such basics as controls and blinding in clinical trials. In general, what we call the scientific method did not seem to these students to be applicable to the practice of clinical medicine.

Compartmentalization of Care

Another phenomenon I discovered in Russia was their traditional institutionalized compartmentalization of care. During Soviet days, Stalin sought to disperse the means of production so that if cotton was

grown in Georgia, textile manufacture would be accomplished elsewhere, so no one region could wield control over the whole process, thus ensuring that the federal government had overall power. Although I have been unable to discover a similar reasoning as the source of the organization of medical care and research in the FSU, the facts on the ground are similar. Care has traditionally been delivered either by hospitals that provide general care only or those that provide specialty care only. Therefore, a patient with major trauma must be taken either to the neurosurgical hospital to have his head wound dealt with, or to the general hospital, where there is a cardiologist or cardiothoracic surgeon who can deal with his chest trauma. No hospital has both. Likewise, research institutes have specialized but limited facilities: one might have excellent animal facilities but be unable to do biochemical analyses, whereas another has excellent chemistry laboratories but no way to house or work with animals.

One of the newest hospitals in Moscow is the Scientific and Practical Center for Pediatric Craniofacial Surgery and Neuropathology. This brand new hospital is a tertiary care center that does head and neck surgery, including craniofacial surgery, neurosurgery for brain tumors, and for other neurovascular conditions. It also has an extensive seizure disorder program and an intensive care unit that cares for newborns with intracranial bleeds as well as head trauma. The physical facilities are impressively up to date and architecturally impressive (Figure 3).

However, there are no cardiologists, orthopedists, or other medical or pediatric specialists available for consultation. Among the advanced technologies available at this center are up-to-date MRI and CT scanners and digital video EEG. In contrast, there is no laboratory that does basic coagulation testing; they cannot measure PT, aPTT, fibrinogen, or clotting factor levels. It is not that the physicians do not understand the utility of such testing. It is that donors and politicians would rather be responsible for budgets that make headlines. While I was in Moscow, this hospital received a second MRI machine, and the Patriarch of the Russian Orthodox Church appeared on the front page, above the centerfold, to present this MRI machine; a simple coagulation analyzer, although cheaper, does not make headlines extolling the advances of the Russian medical system.

Clinical Research at Teaching Hospitals

One general hospital I visited was Moscow Clinical Hospital #15. This hospital's website states it serves nearly 35,000 patients per year, trains residents, and performs research.

FIG. 3. Scientific and Practical Center for Pediatric Craniofacial Surgery and Neuropathology.

The hospital does not have specialized hematology or oncology services, but it is a general hospital with active trauma, obstetric, and cardiac surgery services. Posters on the walls illustrate the research its faculty conducts. One example was entitled "Clinical Research for Individual Simulator Inhaler," by the Moscow State University of Medicine and Dentistry, Department of Exercise Therapy, Sport Medicine and Physiotherapy, City Clinical Hospital #15. A summary of this research essentially stated the following:

- There were 37 subjects, of which 21 were females and 16 males.
- Different forms of respiratory diseases were treated, including acute and chronic bronchitis, bronchial asthma, pneumonia, and "dystonia of hypo- and hypertonic types."
- The treatment consisted of a 2-week course of "health restoration through application of the Individual Simulator Inhaler," which appears to be a device similar to an incentive spirometer.
- The investigators' conclusion was that "all the tested persons showed improvement."
- The investigators further stated that "as the result of our research we revealed that the health restoring effect [of the device] occurs due to its influence on the main factors of lung diseases."

Nowhere in the report was there mention of controls of any sort, any attempt to control for the type of pulmonary process being treated, or any quantitative measurements (such as might have been made by formal pulmonary function testing). No mechanism of action was hypothesized. Although such "studies" appear to be acceptable as research in Russian medicine, they may also explain why physicians and students do not see clinical research as providing valuable evidence on which to base practice. Furthermore, I saw that learning medicine by memorization was stifling logical reasoning. For example, one student asked: "If you treat a patient with high cholesterol with a statin, and the cholesterol goes down, can't you stop the statin?" Only when asked whether the statin would have permanently addressed the cause of the hypercholesterolemia did the student admit that perhaps an analogy could not be drawn to how antibiotics are used and that the process leading to hypercholesterolemia would not have been reversed permanently.

Innovation in Kazan, Tatarstan

Tatarstan and its capital Kazan are far from the corridors of power in Moscow. In fact, most Russians, including those in the federal government, do not much care what happens in Tatarstan as long as it remains peaceful and does not threaten the rest of the country. Tatarstan is a semi-autonomous region with a large Tatar Muslim population (52%), as well as a large ethnic Russian Orthodox population (43%); several other minority groups are also present. It has a medical school (Kazan State Medical University) created on the Soviet model but poorly supported by the government. However, without political support (or resources), the head of the Therapy Department (their nomenclature for a Department of Medicine) is bringing his medical school and hospital into the 21st century. English is emphasized, and residents and faculty attend European medical conferences to hear about current clinical research methodology and results. Medical students are encouraged to conduct research projects, often providing useful information, such as surveying culture results and use of empiric antibiotics to help guide local practice. The faculty is proud of being up-to-date regarding evidence supporting current therapeutic approaches. And despite limited resources, the Hematology Department faculty has improved their acute myelogenous leukemia discharge-in-remission rate to 50% without flow cytometry, molecular diagnosis, or platelet transfusions! In fact, the hematology ward has five patients per room, with less than a yard between some patient beds, making isolation impossible.

Morning report in Kazan would be familiar to anyone at a US medical school (Figure 4). All residents and medical students on the Therapy wards are in attendance as a resident presents a case. The chair of the department and the chief resident sit at the front of the room listening to the case presentation and then asking questions. In one case I heard presented, the house staff had missed the diagnosis of pulmonary embolism while they kept looking for laboratory and ECG signs of myocardial infarction. The department chair firmly but kindly used the Socratic method to lead the presenting resident through an uncomfortable series of questions designed to let her learn from her own mistakes.

With this approach, it appeared that the faculty, residents, and students acquire excellent clinical skills and are familiar with current medical literature and treatment guidelines. And although they cannot obtain such supportive items such as platelet transfusions for patients with leukemia in most cases, they have a fairly good armamentarium of diagnostic tests and can obtain new and even expensive medications for inpatient use. Perhaps most tellingly, in walking the halls, one sees posters announcing the latest activities and meetings of the medical student "Anticorruption Club"! Thus, Kazan is an example of how a visionary leader can affect medical education, as well as medical practice and clinical outcomes.

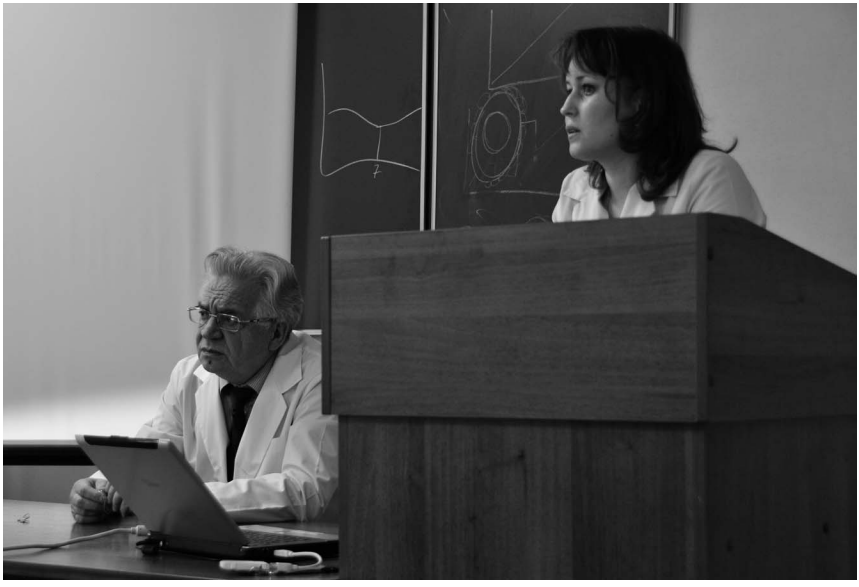

FIG. 4. Morning report in Kazan.

Chisenau, Moldova

In another part of the FSU, I also taught is Chisenau, the capital of Moldova. Moldova is the poorest country in Eastern Europe. Its gross national product per capita was estimated to be $2037 US/y in 2012 and has actually decreased in recent years. Over one third of the gross domestic product is supplied by remittances from Moldovans working abroad (mostly in Europe). Moldova's total health expenditures per capita are approximately $386 US (2), and Soviet era practices persist throughout the country. In fact, although Moldova has two official languages (Romanian and Russian), medical doctors largely come from the Russian-speaking population.

Medical care is largely delivered through low-tech delivery systems. Medical records outside of inpatient records are kept by the patients themselves, who hand-carry them to clinics and doctor appointments. Examination rooms tend to be extremely simply furnished, with low exam tables that have no clean paper or other removable covering. There are no patient gowns and often no exam gloves. Equipment, when present, is often falling apart. Otoscopes and ophthalmoscopes are rarely available and even more rarely used. Shortages of equipment and supplies are constants. Basic tests not done due to their cost include such things as thyroid panels, cholesterol screening, and HgbA1C (Figure 5).

Again, as in the Russian Federation, many doctors who graduate from medical school do not practice. In Chisenau, medical doctors earned $35/month in 2010, whereas store clerks earned three to four times more. Physicians who do work at public hospitals and clinics often moonlight elsewhere, including at a growing number of private clinics catering to the small but slowly increasing population of more well-to-do citizens or those who receive support from relatives abroad when they need medical care.

During my first trip there, I was part of a team sponsored by the Ministry of Health of Moldova, which was trying to modernize transfusion and hematology laboratories. My role was to educate doctors about standard practices in transfusion medicine and laboratory hematology. I lectured for 6 hours a day about the use of laboratory information, decision-making about blood product use, and interpretation of red cell serology. Physicians at several of the largest hospitals in Chisenau were required to attend my lectures, and my topics were pre-approved by the Ministry of Health. Mandatory attendance at lectures being held during a heat wave in un−air-conditioned classrooms understandably left these physicians less than enthusiastic! It soon became clear that I would need to do more than just give straight-

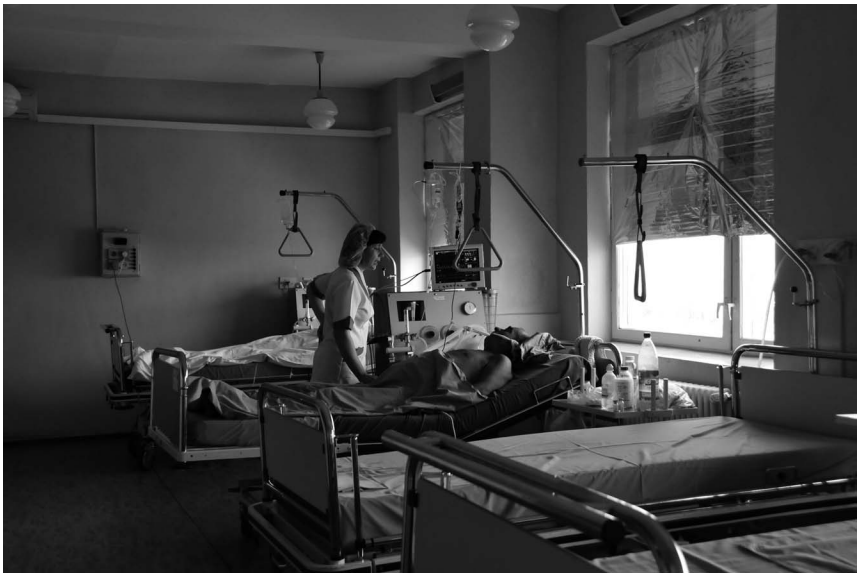

FIG. 5. A "Reanimation Unit" (Intensive Care Unit) at the Oncology Center Hospital in Chisinau.

forward lectures to get them to entertain new approaches to doing their jobs. My strategy for improving communication became to first briefly present my personal "bio," both to establish credibility and to build a relationship in which we had things in common. Thus, after introducing myself and what I did at work in the US, I shared cases in order to develop rapport and participation in problem solving. Finally, I gave my lectures and solicited give and take. Often this meant holding my tongue while listing to their practices, which certainly went against what we in the US teach as good medicine. Nevertheless, by encouraging their participation in case-centered problem solving and allowing for back and forth discussion about various points, they transformed from a passive to an active audience, thus allowing discussion about some of their, from the US perspective, unusual medical practices.

I also visited and lectured at the main National Transfusion Center and lectured physicians and advanced technologists there. For the most part, my audience at the Transfusion Center was enthusiastic and eager to bring their practices up to date. But in addition to knowing little about advanced red cell serological techniques, they also knew little about good laboratory practices in general. Blood tubes were left open on carts in hallways. Instruments were calibrated once annually. Glove use was optional, and gloves were often re-used. The

physical environment was clean but marginal in other ways; our translator fainted from the heat in the room where blood shipments to hospitals were being prepared! And while there were many staff members, there was relatively little activity. We visited the apheresis unit, where they proudly showed off their six modern apheresis machines; but only one was at work that day.

Kazakhstan

At the other end of the economic spectrum extant in the FSU, Kazakhstan is an oil-rich country whose leader, Nursultan Nazarbayev, is determined to compete with the West. Kazakhstan is a huge but relatively sparsely populated country, larger than Western Europe and four times the size of Texas, but with only approximately 17 million inhabitants (approximately 10 million less than Texas). As a former Soviet Republic, it shares a 4000-mile border with Russia and a 1400-mile frontier with China.

One of Nazarbayev's initiatives is to build a new, post-graduate, English-language curriculum medical school and hospital in their newly created capital of Astana (Figure 6).

Many US universities have scrambled to get a piece of this "knowl-

FIG. 6. New construction in Astana, Kazakhstan.

edge economy" pie, and Duke also has contributed in this sphere. Our crew of three physicians and three administrators were there to advise the administration about how to bring together five separate but closely situated hospitals, each with its own specialty area consistent with the Soviet model, and their faculties in order to create the clinical teaching facility of the new medical school. We then participated in a national medical conference during which I discussed the use of EBM as an important part of formulating national health policy. The inherited structure of the hospitals was clearly creating rivalries and conflicts, as they were not used to considering themselves allied in any way whatsoever. Politically and strategically, therefore, gradual unification and coordination of their clinical services and faculties has proven to be quite challenging. And, although many physicians and administrators clearly perceived the value of EBM as a guide to multiple areas of health policy, they still found acquisition of state-of-the-art MRI machines and establishment of bone marrow transplant programs more attractive than addressing the public health needs of their population.

PRESENTING EBM RECOMMENDATIONS TO OUR PATIENTS

If we have trouble convincing our colleagues coming from other traditions in medical education about the value of evidence-based medicine, how can we hope to use EBM to help communicate about medical decision-making to our patients? Will it help them understand why their doctor may no longer recommend (or their insurance companies pay for) annual mammograms or PSA tests? While we believe that how we should treat our patients can be tested in a scientifically valid manner, we also know that we cannot find good evidence to solve all our medical dilemmas. We often give our patients major and complicated choices. Do they want surgery or radiation therapy? Do they want to "watch and wait" or undergo an invasive biopsy? Yet when we try to explain the "evidence" for our recommendations, we often need to explain how the clinical trials were conducted and whether the patient we are treating is like or different from the trial subjects. We also need to explain what questions and controversies about the treatment remain, and why. Can we express these conundrums in a way that helps our patients make the choices we impose on them?

For myself, I believe that trying to teach principles of EBM to physicians with different educational backgrounds and different cultures has made me understand a little more about how to communicate

with my patients. Nevertheless, in the long run, I also believe that our own country has to make sure that all secondary educational institutions teach the principles of the scientific method, logic, and human biology in a competent manner if we are going to succeed in providing our patients with the opportunity to make good choices about their health care. Our patients, and especially our future patients, need to have the tools to understand EBM when we explain it. Only then will we be able to determine if understanding what EBM is will make it easier for patients to choose the treatment they prefer and make it more likely that they will adhere to the choice they make. Or will they still ask: "What would you do if I were your mother / father / brother. . .?"

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DISCUSSION

Ausiello, Boston: I think there is an incredibly important lesson in what you're doing. And I'll take it from my own experiences in helping the Russian government build a new university called Skoltech, which you may be familiar with. The strong, strong science that has evolved in Russia in physics, mathematics, computation, never was part of the cultural heritage in the development of medicine. Medicine was low on the food chain, and it was never appreciated to be a scientific enterprise. And they're now trying to build a multidisciplined approach to science. In activity just north of Moscow, it is evident that bringing together "scientists" in physics, chemistry, and mathematics are largely going to be the tool kits and skill sets that develop a biological repertoire that ultimately will come back to medicine. And so I would posit that the biggest skill and tool that we bring to our patients is that we do feel that we are well-grounded in a scientific enterprise, and that we should continue to emphasize that to all of our patients no matter whether there is evidence or not for an existing treatment.

Telen, Durham: Thank you.

Weinblatt, Boston: I'd like your perspective on therapeutic trials that are now being done in Russia. As major pharmaceutical and biotech companies have noted difficulty in recruitment from North America and Western Europe, there has been a significant shift to studies being done now in the FSU. Some of us have concerns about the validity of the data and the high placebo, as well as active drug effects and low adverse event rates that are being reported. What is your experience in Russia? Tell us about these studies, this trend towards increasing recruitment from some other developing countries, and the impact that has upon the pharmaceutical industry.

Telen, Durham: So I think that you raise some really important questions. Certainly the environment that patients are being recruited from in Russia is different in many respects. Although healthcare is guaranteed, it is certainly not always up to what we would consider a standard acceptable to us. Not only that, healthcare's guaranteed; drugs are not. And so, often the patients have to buy their own drugs even if their

physician's care or their hospital care is guaranteed. And so, participating in clinical trials is often seen, I think, by Russian patients as possibly, you know, a big advantage, because it helps them get the basic care that they need. So that may be a lot of the placebo effect. There is a very different style of communication between physicians and patients in Russia. And so I am absolutely sure that for most patients, unless you really question people hard about adverse events, you'll find out very little. So I wouldn't be surprised if most adverse events, unless they're serious adverse events, do not get reported. And so, the other thing is that I think the motivations for physicians are sometimes very different; why they are participating in trials. A lot of these hospitals are strapped. I mean, they are strapped for really basic equipment. So if a pharmaceutical company is going to come in—and even if it's just going to buy them a couple of new ECG machines—this is very attractive to a lot of these hospitals. And so it's not that we in the United States who do clinical research do not do it for the money, because we do. But we do it for other reasons too. But we also do it for the money! But there is a different driver here. And the last thing that someone pointed out to me, actually before I left—when I started trying to read up on all of this stuff—was that there can be a difference in impacts of drugs in different places because of the underlying care. So there was a study of activated protein-C, I think in sepsis, that was published a number of years ago. And when they looked at where the study was done, it was international. So it was really all over the place. In the countries that had what we would consider as maybe poorer quality ICUs, the activated protein-C seemed to improve things. In the United States, it had no effect. So in total, you might get an answer one way or the other, but it was really dependent on what the infrastructure of care was. And I think that may also be a problem in at least some of these pharmaceutical studies.